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Neurofunctional Characterization of Verbal Fluency in Successful Aging

Yannick Marsolais^{a,*}, Yves Joanette^b^a *Centre de recherche, Institut universitaire de gériatrie de Montréal/Département de psychologie, Université de Montréal*^b *Centre de recherche, Institut universitaire de gériatrie de Montréal/Faculté de médecine, Université de Montréal*

Introduction

A growing number of studies suggests that the deleterious effect of aging can be modulated by various aspects of experience in everyday life, such as education (e.g. Stern, 2009), which may contribute to the relative preservation of some cognitive abilities (“successful aging”). Moreover, optimal cognitive functioning in well-educated older adults has often been linked with changes in patterns of brain activations for many aspects of perception and cognition (e.g. Cabeza, 2002). However, few studies have investigated the neurofunctional changes underlying expressive language abilities such as verbal fluency. The goal of this study was to use functional magnetic resonance imaging (fMRI) to assess the effect of aging on a verbal fluency task with regards to highly educated younger and older adults.

Methods

Twelve younger (aged 20 to 31) and 12 older (aged 60 to 73) healthy, highly educated ($M = 17$ years of education), right-handed French-speaking adults, with no signs of language, psychiatric or neurological pathology (e.g. MMSE > 27) performed a verbal fluency task in a 3T fMRI scanner. They were asked to say as many words as possible given 4 orthographic and 4 semantic criteria, within a limited amount of time (90 seconds/criterion). The reference task consisted of repeating months of the year. The fMRI acquisitions were made within a mixed design consisting of a single functional run (1600 s, TR = 2).

Results

At the behavioral level, a 2-way ANOVA performed on the mean production of words revealed that neither of the main effects of age (younger vs older adults) or criterion (semantic vs orthographic), nor the interaction, achieved statistical significance. At the neurofunctional level, a 2-way mixed ANOVA (flexible factorial, FWE-corr. = .05) revealed that only the main effect of criterion was significant. Post-hoc analysis contrasting the different fluency criteria revealed significant activations in various brain regions (e.g. left precuneus & left pars triangularis of the frontal inferior gyrus for the “semantic vs reference” contrast).

Conclusion

Although differences were found at a neurofunctional level for the different verbal fluency criteria, younger and older adults showed similar performances and patterns of brain activations when performing this task. Such results are considered in light of currently discussed neurofunctional reorganization principles, including inter-

* Corresponding author.

E-mail address: yannick.marsolais@umontreal.ca.

and intra-hemispheric changes, globally taken as expressing the presence of a brain reserve.

References

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